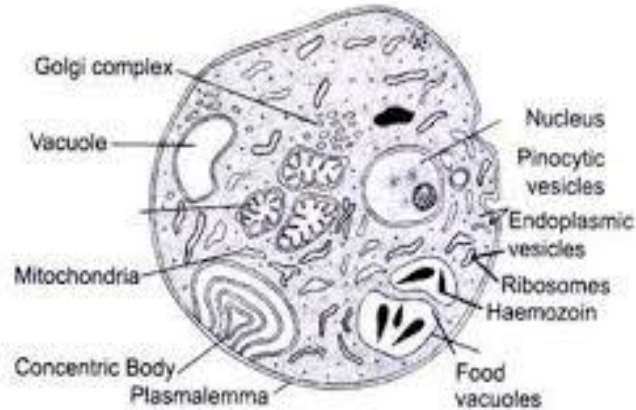


M.Sc. I Sem: Applied Zoology (ZOPALO1) OEC
(Lab. Exercises)

Ex.1. Study of various disease causing pathogens.

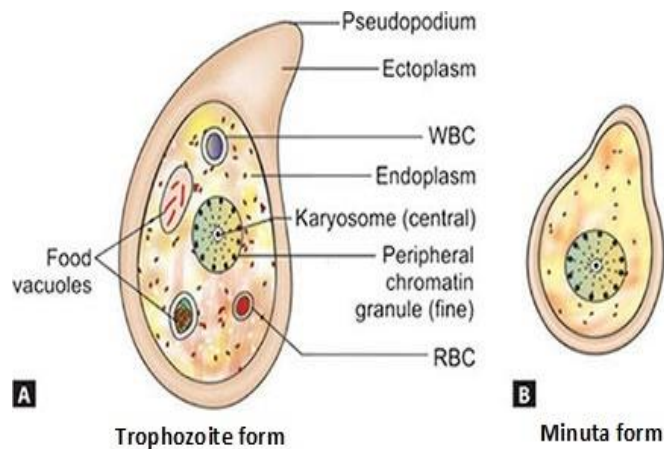
1. *Plasmodium*



***Plasmodium* (Adult trophozoite)**

- **Systematic position:**
- **Phylum-** Protozoa **Class-** Sporozoa **Order-** Haemosporidia
- **Genus-** *Plasmodium* **Species-** *vivax*
- **-Comments:**
- It is adult stage of *Plasmodium* which is disc shaped and surrounded by a bilayer plasmalemma.
- Cytoplasm contains nucleus, endoplasmic vesicle, ribosomes, mitochondria, Golgi apparatus, food vacuoles with haemozoin granules, concentric body, etc.
- It feeds by pinocytosis.

2. *Entamoeba*



(Entamoeba histolytica)

-Systematic position:

Phylum – Protozoa **Class-** Rhizopoda **Order-** Amoebida

Genus- *Entamoeba* **Species-** *histolytica*

-Comments:

It occurs in two distinct forms:

-(1) Trophozoite or Magna form:

-It is oval, most active, motile and feeding form which is pathogenic to man.

-It is 20-30 μ in diameter.

-Outermost covering is plasmalemma. Cytoplasm is differentiated into ectoplasm and endoplasm.

-Endoplasm contains nucleus and food vacuoles.

-At anterior end, single pseudopodium is present for locomotion (monopodial).

-Nutrition is holozoic and feeds by phagocytosis.

-These are developed from minuta form.

-These penetrate the intestinal wall and ingests erythrocytes.

-They also spread to other tissues, chiefly the liver and lungs, brain and testes also.

(2) Precystic or minuta form:

-It is small, spherical, non-motile and non-feeding form.

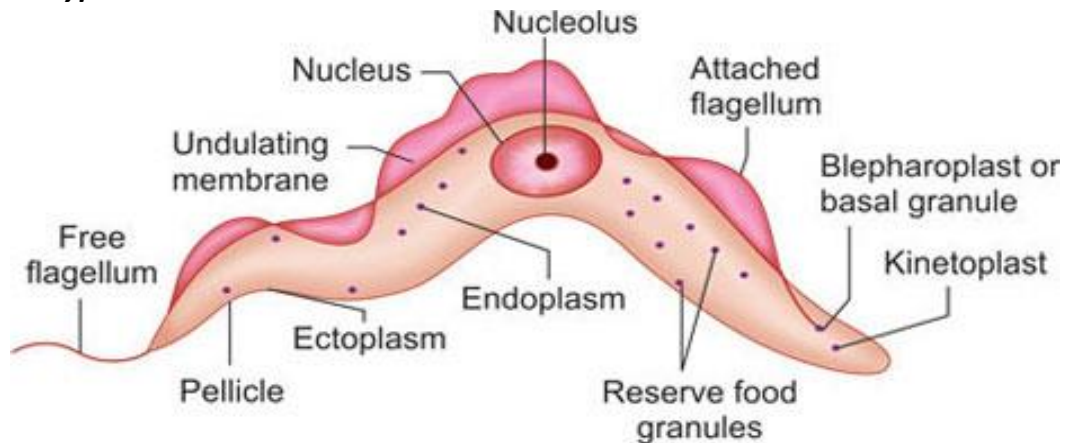
-It is non-pathogenic to man.

-It measures 12-15 μ in diameter.

-Generally they live in the lumen of intestine.

-They are encysted and then transmitted from one host to other.

3. Trypanosoma



(Trypanosoma gambiense)

-Systematic position:

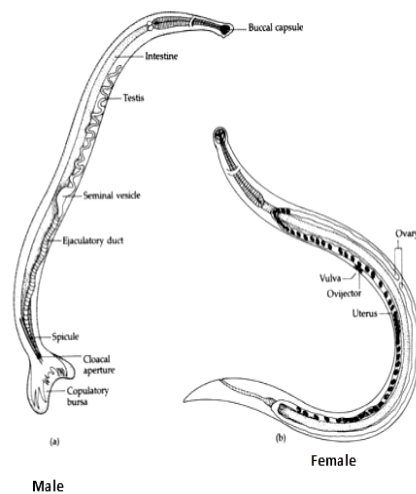
Phylum- Protozoa **Class-** Flagellata **Order-** Kinetoplastida

Genus- *Trypanosoma* **Species-** *gambiense*

-Comments:

- It is microscopic, elongate, leaf like, flattened and tapering at both ends.
- It is 10-40 μ in length.
- Anterior end is pointed while the posterior end is blunt.
- It is thin, elastic and firm which covers the body.
- It contains microtubules which maintains the body shape.
- It is uniflagellate.
- Flagellum arises from a basal body (Kinetosome- Kinetoplast + Blepharoplast), situated near the posterior end.
- It runs forwardly and attached along the entire length of the body and becomes free at anterior end.
- During movement, undulating waves pass from tip to the base of the flagellum.
- It is the membranous fold of pellicle which is helpful in locomotion in the viscous fluid.
- It is covered by pellicle and not differentiated into ectoplasm and endoplasm.
- It contains a single nucleus, mitochondrion, Golgi body, endoplasmic reticulum, ribosomes, volutin granules (stored food particles- glycogen and phosphates), lysosomes vacuoles, etc.
- It is single, large, oval ad vesicular.
- Nucleolus/endosome is centrally placed.
- Chromosomes are scattered in nucleoplasm.

4. *Ancylostoma*



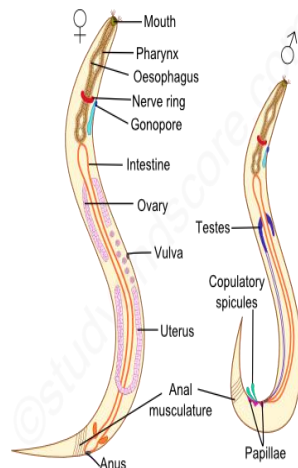
(*Ancylostoma duodenale*)

- **-Systematic Position:**
- **Phylum-** Aschelminthes **Class-** Phasmdia **Order-** Strongyloidea
- **Genus-** *Ancylostoma* **Species-** *duodonale*

-Comments:

- It is unisexual, cylindrical and white or grey in colour.
- Female (10-13 mm) is longer than male (8-11 mm).
- Anterior end of both are curved hence named hook worm.
- Mouth is armed with one pair cutting plates with teeth and two sharp teeth/lancets for attachment with the host intestine.
- The posterior end of female is tapering while that of male is umbrella like, copulatory bursa surrounds the cloaca.
- The worms secrete an anti-coagulant.
- Male has only one testis and opens into cloaca.
- Female has two ovarian tubules, one anterior and the other posterior to the level of gonopore.
- Both vaginae open outside through gonopore or vulva.

5. *Wuchereria*



(*Wuchereria bancrofti*)

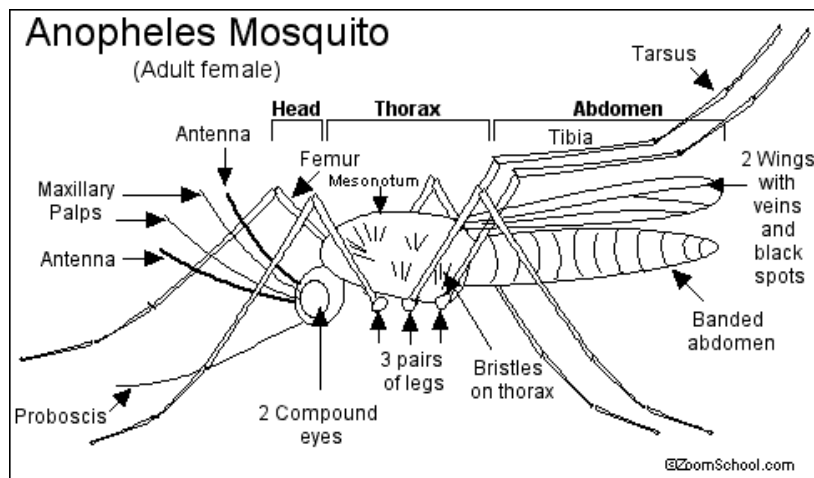
- **-Systematic position:**
- **Phylum-** Nematoda **Class-** Phasmidia **Order-** Filaroidae **Genus-** *Wuchereria*
Species- *bancrofti*

-Comments:

- These are filiform and cylindrical.
- Both ends are blunt.
- They are creamy white in colour.
- It is unisexual and a distinct sexual dimorphism is present.
- Female is longer (65 to 100 mm) than male (40 mm).
- Posterior end of male is sharply curved ventrally.
- In female, vulva or genital pore is located ventrally in the pharyngeal region.

Ex.2 Study of important arthropod vectors associated with human disease.

1. Anopheles



-Classification:

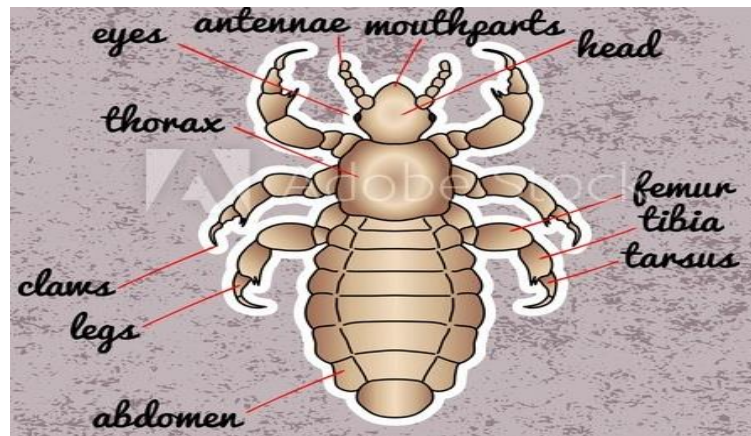
Phylum- Arthropoda **Class-** Insecta **Order-** Diptera **Family-** Culicidae

Sub-family- Anophelinae **Genus-** *Anopheles* **Species-** *gambiae*

-Comments:

1. Adult *Anopheles* species have slender bodies with three sections: head, thorax and abdomen.
2. Body colour is light grey with patches.
3. The head contains the one pair compound eyes, mouth parts and a pair of long many-segmented antennae.
4. Mouth parts are piercing and sucking type. Female is blood sucking, while male feeds on plant sap.
5. Antennae are pilose (female) and plumose (male) type.
6. Three pairs of legs and a pair of wings are attached to the thorax.
7. Adults rest with their abdomens sticking up in the substratum.
8. Adults are aerial while life cycle is aquatic.
9. Female *Anopheles* harbours the *Plasmodium* (malaria parasite).

2. Pediculus



(*Pediculus*)

-Classification:

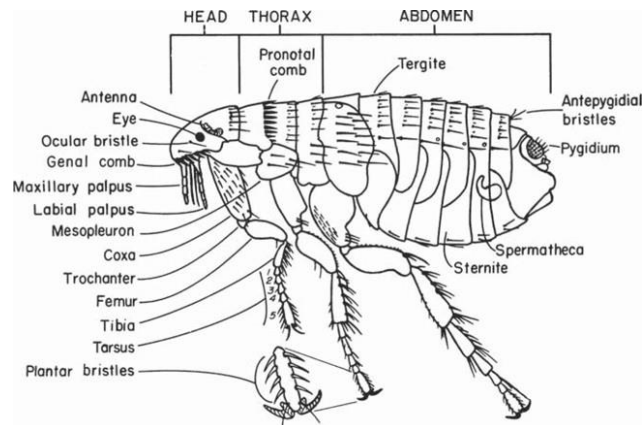
Phylum- Arthropoda **Class-** Insecta **Order-** Siphunculata

Genus- *Pediculus*

-Comments:

- -Adults are 1.5–2.0 mm long and flattened.
- -Grayish-white in color.
- -Females are usually larger than males.
- -Body is dorso-ventrally flat and lacks wings.
- Mouth parts are piercing and sucking type.
- -Legs are clawed.
- -Adults are found only on the human host and require human blood to survive.

3. Xenopsylla



(*Xenopsylla*)

-Classification:

Phylum- Arthropoda **Class-** Insecta **Order-** Siphonoptera

Genus- *Pediculus*

-Comments:

- -The adult fleas are tiny, 1 mm, oblong.
- Laterally compressed body.
- Hard skinned.
- Wingless and dark brown insects.
- Having piercing and sucking type of mouth parts.
- It has concealed antennae and long jumping legs.

Ex.3 Study of identifying features of different insect pests.

1. *Pyrilla*



(*Pyrilla perpusilla*)

-Classification:

Phylum- Arthropoda **Class-** Insecta **Order-** Hemiptera

Family- Lophopidae **Genus-** *Pyrilla* **Species-** *perpusilla*

-Comments:

1. It is commonly known as Leaf hopper.
2. The pest is found throughout the Indian subcontinent from Afganistan to Burma & Thailand.
3. It is a serious pest of sugarcane in Northern India.
4. It also occasionally feeds on maize, millets, rice, barley, oats, sorghum, etc. plants.
5. The adult insect is straw colored bug.
6. Head projecting as rostrum which encloses the stylets.
7. Tarsi are two and two elongated and twisted anal processes.
8. The two pairs of wings generally remain folded over the back.
9. Mouth parts are piercing and sucking type.

2. *Papilio*



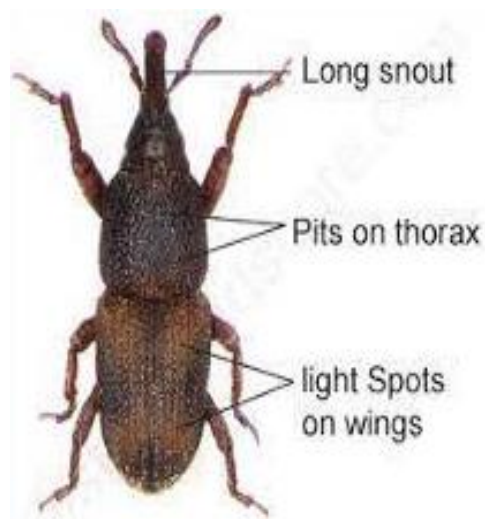
(*Papilio demoleus*)

-Classification: Phylum- Arthropoda Class- Insecta Order- Lepidoptera Family- Papilionidae Genus- *Papilio* Species- *demoleus*

-Comments:

1. It is commonly known as the lime butterfly.
2. The citrus/lemon butterfly is found in Africa, Asia as far as Taiwan and Japan. It has been reported all over India.
3. Most common host plants are citrus plants.
4. The adult is a large and beautiful butterfly. It is 2.8 cm in length and 9.4 cm in wing expanse.
5. Its head and thorax are black.
6. Underside of the abdomen, has creamy-yellow colouration.
7. Its wings are dull black; ornamented with yellow markings.
8. The larvae show preference for young and shiny leaves of citrus.

3. *Sitophilus*



(*Sitophilus oryzae*)

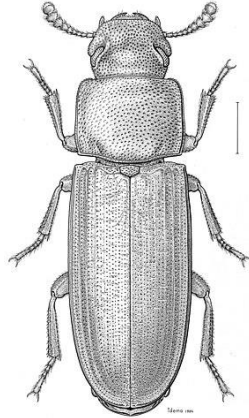
-Classification:

Phylum- Arthropoda **Class-** Insecta **Order-** Coleoptera **Family-** Curculionidae **Genus-** *Sitophilus* **Species-** *oryzae*

-Comments:

1. It is commonly called as Rice weevil.
2. It is found all over the country.
3. Host food grains rice, wheat, maize, barley, jowar, etc.
4. Adult weevil is 3.5 mm long. It is cylindrical in shape and brown in colour.
5. It's rostrum is 1 mm long.
6. Antennae are one pair, strong, clavate and elbowed.
7. Mouthparts are biting and chewing type.
8. One pair compound eyes are present at the base of antennae.
9. Abdomen is completely covered by elytra, on which four light red or yellow coloured spots are found.
10. Legs are long.
11. It boars the grain and lay the eggs in it.
12. Grubs and adult both undergo in hibernation.

4. Tribolium



(*Tribolium castaneum*)

-Classification:

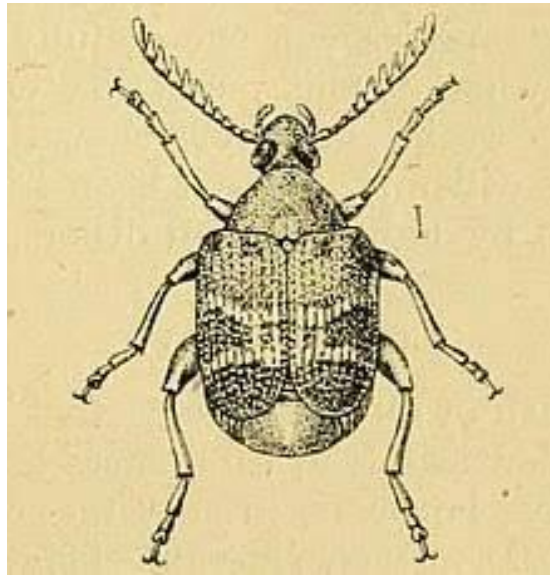
Phylum- Arthropoda **Class-** Insecta **Order-** Coleoptera
Family- Tenebrionidae **Genus-** *Tribolium* **Species-** *castaneum*

-Comments:

1. It is commonly known as red flour beetle.
2. It is a worldwide pest of stored products, particularly food grains.

3. The red flour beetle attacks stored grain (maize, wheat, etc.) and other food products including flour, cereals, pasta, biscuits, beans, and nuts.
4. Adult beetles are flat, small and around 3-4mm long.
5. The adult is raddish-brown in colour.
6. The adult is long-lived, sometimes living more than three years.
7. Adults fly in large numbers in the late afternoon.

5. *Callosobruchus*



(*Callosobruchus chinensis*)

-Classification:

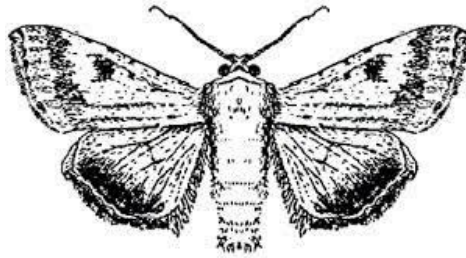
Phylum- Arthropoda **Class-** Insecta **Order-** Coleoptera

Family- Brucidae **Genus-** *Callosobruchus* **Species-** *chinensis*

-Comments:

1. It is commonly known as pulse beetle.
2. It is cosmopolitan in distribution pattern. Natural ranges are in the tropics and subtropics of Asia.
3. Both the larvae and the adults feed on the legumes of green gram, lentil (masoor), cowpea (lobia), pigeon pea (arhar), chickpea (kabuli chana), etc. and various stored pulses.
4. It is a small insect, measuring about 5 mm in length as an adult.
5. The antennae are pectinate in males while in females, serrate.
- 6, Unlike true weevils, it has no snout.
7. It is brown in colour with black and grey patches over the body.
8. The abdomen of the female is slightly longer than the elytra and it is white in colour with two oval black spots on it. It is also larger and heavier than the male.
9. The adults are capable of flight.

6. *Helicoverpa*



(*Helicoverpa armigera*)

-Classification:

Phylum- Arthropoda **Class-** Insecta **Order-** Lepidoptera **Family-** Noctuidae
Genus- *Helicoverpa* **Species-** *armigera*

-Comments:

1. It is commonly known as gram pod borer.
2. It is widespread in several countries. It is also widely distributed in India.
3. It is highly polyphagous species. The young larvae feed on the foliage and later bore into the pods and feed on the developing grains.
4. It is a serious pest of chickpea, pigeon pea, mung bean, urd bean, lentil, soybean and cowpea.
5. It also damages cotton, sorghum, okra, maize, tomato, berseem, sunflower and lately wheat also.
6. The moth is stoutly built.
7. It is yellowish brown in colour.
8. There is a dark speck and a dark area near the outer margin of each forewing. The fore wings are marked with grayish wavy lines and black spots and a round spot on the upper side. On the underside of fore wing, a black kidney shaped mark and a round spot are present.
9. The hind wings are whitish and lighter in colour with a broad band along the outer margin.

Ex.4 Study of insect damage to different plant parts/stored grains.

1. Damage by sugar cane pest (*Pyrilla*)

- Nature and extent of damage:
- The damage to sugarcane is caused by both adults and nymphs.
- They suck up plant sap that causes yellowing and drying of leaves.
- Photosynthesis is reduced resulting in the reduction of sucrose content of the juice by up to 30%.
- Hoppers secrete a sweet substance called honey dew that coats the leaves and attracts a blackish fungus, which reduces photosynthesis resulting in yield loss.



- **-Control:**
- 1. Burn the crop residues
- 2. Removal of the leaves bearing eggs
- 3. Uprooting and destruction of seriously infected plants
- 4. Dusting the infected crop with BHC, malathion, carbaryl, etc.
- 5. Spraying with endosulfan, endrin, phosphamedon, etc
- 6. Introducing hyper-parasites which destroy eggs, nymphs and adults.

2. Damage by citrus plant pest (*Papilio*)

- **Nature and extent of damage:**
- The young larvae feed only on fresh leaves and terminal shoots.
- In later stages, they feed even on mature leaves and sometimes the entire plant may be defoliated.
- The pest is particularly devastating in nurseries and its damage to foliage seems to synchronize with fresh growth of citrus plants.
- Heavily attacked plants bear no fruits.



- **-Control/management:**
- 1. Hand picking of various stages of the pest and their destruction helps to suppress the population of the pest.

- 2. Spraying of entomogenous, *Bacillus thuringiensis*, or neem seed extract also give quite high mortality of caterpillars.
- 3. In severe infestation, spray of endosulfan, carbaryl 50 WP or quinalphos is very effective.
- In India, these wasp parasitoids are known to parasitize *P. demoleus* larvae: *Apanteles* (Caterpillar parasitoid) and *Trichogramma* (egg parasitoid).

3. Damage by rice grain pest (*Sitophilus*)

- **-Nature and extent of damage:**
- Both grubs and adults make the grains hollow after eating the internal contents, hence cause severe damage to the grains.
- High moisture is favourable for weevial attack or infection by fungi and grains turn black.
- These secondary infections by fungi are so severe that stored grains are completely destroyed.



- **-Control:**
- 1. Before storage of grains, godowns should be cleaned properly and crevices should be sealed
- 2. Grains should be dried completely, otherwise damage will be more severe.
- 3. Grains should be treated with EDCT mixture (Ethylene dichloride-Carbon tetrachloride).
- 4. Before storage, the godowns should be fumigated for 24 hours with ethylene dichloride or CCl₄ and carbon bisulphide mixture.
- 5. Store house may also be fumigated with aluminium phosphide or celphos.
- 6. Pusa bin, Hapur bin or Pantnagar kuthla should be used for storage.

4. Damage by flour beetle (*Tribolium*)

- **Nature and extent of damage:**
- Infestation is apparent by the appearance of adults on the surface of the flour.
- They also cause extensive damage to previously holed or broken grains, or grain damaged by other pests.
- Damage is done by both larvae and adults.



-Control:

- The shelled grains should be thoroughly admixed with BHC dust or powder, if locally permitted.
- Fumigation should only be carried out by approved operators.

5. Damage by pulse beetle (*Callosobruchus*)

- **Nature and extent of damage:**
- The pest attacks leguminous pods in the field from where they are carried to storage godowns.
- The larvae bore into the pulse grains and feed and develop inside.
- The infestation in case of grains in early stages can not be detected since the hole through which it enters is very minute.
- The damaged grains are hollow from inside, bearing small holes and are unfit for human consumption.



- **-Control:**
- Cultural control can be achieved by growing susceptible crop at least a kilometer away from storage godowns, which are the main source of infestation.
- Fumigation with methyl bromide in the stores is very effective but proper precautions must be taken because of the high toxicity of this compound.

6. Damage by gram pod boarer (*Helicoverpa*)

- **Nature and extent of damage:**
- Although, they prefer, food plants like gram and red gram, the larvae are polyphagous.
- They feed on foliage, when young, and on the seeds in later stages, and thus reduce yield.
- A single larva may destroy 30 - 40 pods before it reaches maturity.



Ex.5 Visit to poultry farm and submission of visit report